

*Louisiana State U.*

FIRST PROGRESS REPORT

1 September 1965 to 1 March 1966

NASA Research Grant NGR-19-001-009

The investigation pursued under NASA Research Grant NGR-19-001-009 has two immediate objectives: (1) to check the spectroscopic evidence which indicates the possible variability of the NIII emission lines at  $\lambda\lambda 4634$ ,  $4640$  and  $\lambda 4641$ , and (2) to investigate the suitability of these nitrogen emission lines as luminosity criteria.

Characteristics for the narrow-band interference filters which have been purchased from Baird Atomic, Inc., are given in Table I. The observational index to be defined at each effective wavelength results from a comparison of the intensity observed through a 40A half-width filter to that measured through a filter of 180A half-width. Both filters are centered at the same wavelength. Since the HeII  $\lambda 4686$  line in emission is also a defining characteristic for the O stars (Underhill 1960), it was decided to investigate its properties simultaneously with the study of the three nitrogen lines. The third column indicates the maximum transmission of each filter; the second column indicates the band-width of each filter at the half-intensity points, that is, at one-half of the maximum transmission. The filter characteristics were determined through use of the Kitt Peak National Observatory Cary monochromator.

Reduction of the data will lead to indices of the form:

$$\text{index magnitude at } \lambda 4637 = 2.5 \log \left( \frac{\text{narrow}}{\text{band}} \right) \lambda 4637 - 2.5 \log \left( \frac{\text{broad}}{\text{band}} \right) \lambda 4637 \quad (1)$$

N67-81169	(THRU)
4	<i>Now</i>
(PAGES)	(CODE)
CB 70206	(CATEGORY)
(NASA CR OR TMX OR AD NUMBER)	

~~SECRET~~

TABLE I  
Interference Filter Characteristics

Wavelength (A)	Band-width at half-intensity	Transmission (%)
4637 (narrow)	45 <sup>0</sup> A	59
4637 (broad)	174 <sup>0</sup> A	64
4686 (narrow)	40 <sup>0</sup> A	47
4686 (broad)	186 <sup>0</sup> A	48

and,

$$\text{index magnitude at } \lambda 4686 = 2.5 \log \left( \frac{\text{narrow}}{\text{band}} \right)_{\lambda 4686} - 2.5 \log \left( \frac{\text{broad}}{\text{band}} \right)_{\lambda 4686} \quad (2)$$

The resulting indices will be referred to, respectively, as the nitrogen index and the helium index from here on.

Two observing runs on the O-Of star program have been undertaken to date. The initial session took place in late September and early October, 1965, at the Kitt Peak National Observatory. The majority of the observations were made with the No. 4 16-inch telescope. The KPNO 36-inch reflector was used on the fainter field objects and on the O-Of stars in the association surrounding the galactic clusters h and  $\chi$  Persei (Wildev 1964). Observations were made at both the  $\lambda 4637$  and  $\lambda 4686$  wavelengths. A second observing run plagued by very poor weather, for Kitt Peak, was scheduled in late December, 1965, and early January, 1966. Observations were made entirely on the KPNO No. 4 16-inch of bright winter-sky stars. Reduction of the data obtained during both observing sessions is underway.

Future observing runs are planned to increase the number of observations per star; it is planned to utilize the KPNO 36-inch on the fainter objects, thereby assuring higher accuracy per measurement for them. It is hoped that the final probable errors will be less than  $\pm 0.01$  magnitude.

Selected B8-A2 supergiants are being used as comparison stars in the O-Of star program. Since their spectrum is essentially pure continuum at the wavelengths under investigation, these supergiants should be capable of providing stable reference indices. The differential photometric technique is similar to that used in broad band photometry of variable stars. The accuracy quoted above should, in this way, be achievable.

Three stars (9 Sge, HD 190429, HD 34656) in which the nitrogen emission lines spectroscopically seemed to vary (Slettebak 1956) were observed nearly continuously for hours-on-end on several nights. Once the reductions are complete, and the individual measurements are compared to the A-supergiants being used as comparison stars, one will be able to define the range in variation. Initial results for 9 Sge seem to indicate a variation on the order of 0.03 magnitudes in the nitrogen index. Although one would probably not expect any periodic phenomena to be present, an attempt will be made to search for them. It may well be a difficult undertaking since many of these early spectral type stars are binaries; hence, there may be a combination of periods.

## REFERENCES

- Slettebak, A., 1956, Astrophysical Journal, 124, 173.
- Underhill, A., 1960, Stellar Atmospheres, ed. J. L. Greenstein (Chicago: University of Chicago Press), p. 425.
- Willey, R. L., 1964, Astrophysical Journal Supplement Series, 8, 439.